What we claim is:

1.   A method for reducing crosstalk in DSL Discrete Multi-tone (DMT) modems

with the presence of other modulated signals, comprising:

5   receiving a signal that comprise a desired DMT signal plus an interferer from a

channel;

        frequency shifting the received signal to produce multiple versions of the received

signal;

        providing a combined crosstalk equalizer and frequency-shifted adaptive filters to

10   reconstruct the DMT signal and reduce crosstalk noise;

        downsampling the signal outputs of both the combined crosstalk equalizer and the

frequency-shifted adaptive filters to reduce sampling rate; and

        summing the outputs of the combined crosstalk equalizer and the frequency-

shifted adaptive filters.

15   2.   The method of claim 1, wherein the combined crosstalk equalizer equalizes the

channel and removes crosstalk.

3.   The method of claim 1, wherein during training, the output of the combined

crosstalk equalizer matches the output of a target filter that receives a noiseless training

sequence.

20   4.   The method of claim 3, wherein the combined crosstalk equalizer is trained in the

absence of the desired signal.

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5.   The method of claim 3, wherein during training, the combined crosstalk equalizer

is constructed with one tap to avoid distortion of the desired DMT signal.

6.   The method of claim 3, wherein the combined crosstalk equalizer and the

frequency-shifted adaptive filters are trained in the presence of the desired DMT signal

5   to avoid self-interference of the desired upon itself.

7.   The method of claim 1, wherein a replica of the desired DMT signal is generated

locally at the receiver.

8.   The method of claim 1, wherein the interferer is cyclostationary signal.

9.   The method of claim 8, wherein the is cyclostationary signal is an ISDN signal.

10   10.   The method of claim 9, wherein the ISDN signal is a TCM-ISDN signal.

11.   The method of claim 8, wherein spectral components of the interferer signal side

lobes cancel each other.

12.   The method of claim 1, wherein the frequency-shifting of the received signal

corresponds to multiples of the ISDN baud rate.

15   13.   The method of claim 1, wherein the sampling rate is conserved at a high rate to

avoid aliasing.

14.   The method of claim 1, wherein one of a group of fixed, low-pass, high-pass, or

band-pass filters are implemented in order to isolate the desired signal components from

the interferer signal.

20   15.   An apparatus for reducing crosstalk in DSL Discrete Multi-tone (DMT) modems

with the presence of other modulated signals, comprising:

a receiver for receiving a signal that comprises a desired DMT signal plus an interferer from a channel;

a frequency-shifter that produces multiple versions of the received signal;

a combined crosstalk equalizer and frequency-shifted adaptive filters to

5   reconstruct the DMT signal and reduce crosstalk noise;

downsamplers to downsample the signal outputs of both the combined crosstalk equalizer and the frequency-shifted adaptive filters to reduce sampling rate; and

a combiner that sums the outputs of the combined crosstalk equalizer and the frequency-shifted adaptive filters.

10   16.   The apparatus of claim 15, wherein the combined crosstalk equalizer equalizes the channel and removes crosstalk.

17.   The apparatus of claim 15, wherein during training, the output of the combined crosstalk equalizer matches the output of a target filter that receives a noiseless training sequence.

15   18.   The apparatus of claim 17, wherein the combined crosstalk equalizer is trained in the absence of the desired signal.

19.   The apparatus of claim 17, wherein during training, the combined crosstalk equalizer is constructed with one tap to avoid distortion of the desired DMT signal.

20.   The apparatus of claim 17, wherein the combined crosstalk equalizer and the

20   frequency-shifted adaptive filters are trained in the presence of the desired DMT signal to avoid self-interference of the desired upon itself.

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21.   The apparatus of claim 15, wherein a replica of the desired DMT signal is

generated locally at the receiver.

22.   The apparatus of claim 15, wherein the interferer is cyclostationary signal.

23.   The apparatus of claim 22, wherein the is cyclostationary signal is an ISDN

5   signal.

24.   The apparatus of claim 23, wherein the ISDN signal is a TCM-ISDN signal.

25.   The apparatus of claim 22, wherein spectral components of the interferer signal

side lobes cancel each other.

26.   The apparatus of claim 15, wherein the frequency-shifting of the received signal

10   corresponds to multiples of the ISDN baud rate.

27.   The apparatus of claim 15, wherein the sampling rate is conserved at a high rate to

avoid aliasing.

28.   The apparatus of claim 15, wherein one of a group of fixed, low-pass, high-pass,

or band-pass filters are implemented in order to isolate the desired signal components

15   from the interferer signal.